ISSN 2301-4490

PROCEEDING

The 6th International Conference on Green Technology

Malang, 18-19 September 2015

Innovation in Islamic Perspective for Sustainable Development Action Toward International Challenges

Science and Technology Faculty
Maulana Malik Ibrahim Statae Islamic University
Jalan Gajayana 50 Malang, Jawa Timur, Indonesia

PROCEEDING

The 6th International Conference on

Green Technology

Innovation in Islamic Perspective

for Sustainable Development Action Toward International Challenges

Malang, 18-19 September 2015

ISSN 2301-4490

Science and Technology Faculty

Maulana Malik Ibrahim Statae Islamic University

Jalan Gajayana 50 Malang, Jawa Timur, Indonesia

Committee

Steering Committee :
Dr. drh. Hj. Bayyinatul Muchtaromah, M.Si
Dr. Sri Harini, M. Si
Aldrin Yusuf Firmansyah, MT
Linda Salma Anggreani, S.Si, MT
Mohammad Nafie Jauhari, M.Si

Editor

Prof. Toshifumi Sakaguchi
Dr. Nor Atiah Ismail
Assoc Prof. Dr. Akira Kikuchi
Prof. Madya Dr. Mohamad Shanudin Zakariya
Prof. Drs. Ec. Ir. Riyanarto Sarno, M.Sc.,Ph.D.
Priyantono Rudito Ph.D
Dr. Cahyo Crysdian
Dr. Suhartono, M.Kom
Dr. Muhammad Faisal, MT
Dr. Mokhamad Amin Haryadi, MT
Dr. H. Imam Sujarwo, M.Pd
Dr. Abdussakir, M.Pd
Dr. Drs. Usman Pagalay, M.Si
Dr. Agus Mulyono, M.Kes
Dr. Ulfah Utami, M. Si
Dr. Dra. Retno Susilowati, M.Si
Dr. Evika Sandi Savitri, MP
Elok Kamilah Hayati, M. Si
Yulia Eka Putrie, MT

Scientific Committee:

Supriyono, M.Kom
Fachrur Rozi, M.Si
Erna Hastuti, M.Si
Dr. Agung Sedayu, MT
Tri Kustono Adi, M.Sc
Dwi Suheriyanto, S.Si., M.P
Begum Fauziyah, M.Farm

Organizing Committe

Dr. Eko Budi Minarno, M.Pd
Citra Fidya Atmalia, SH
Muhammad Ismail Marzuki, SE
Tuti Indayani, SE
Mujahidin Ahmad, S.Pt., M.Sc
Roro Indah Melani, MT, M.Sc
Ririen Kusumawati, M.Kom
Ainatul Mardiyah, M.Cs
Rusianah, S.Kom
Nur Farida, S.Psi
Abidin, S.Pd
Hendri Cahyo Gunawan, S.Kom
Eka Arif Santoso
Aan Fuad Subarkah, S.Kom
Weni Susilowati, S.AB
Irjatul Wardah, S.Kom
Oktarina Eka Hartanti, SE
Muhammad Hatif, S.Pd I
Ernaning Setiyowati, MT
Ivana Varita, S.Kom
Prima Kurniawaty, ST., M.Si
Deny Zainal Arifin, S.Kom
Anton Prasetyo, S.Si
Ahmad Latif Qosim, S.Kom
Tarranita Kusumadewi, MT
Sri Winarni, MT
Gianto Widodo, S.Kom
Aziz Mustofa, S.Kom

Committee

Steering Committee :
Dr. drh. Hj. Bayyinatul Muchtaromah, M.Si
Dr. Sri Harini, M. Si
Aldrin Yusuf Firmansyah, MT
Linda Salma Anggreani, S.Si, MT
Mohammad Nafie Jauhari, M.Si

Editor

Prof. Toshifumi Sakaguchi
Dr. Nor Atiah Ismail
Assoc Prof. Dr. Akira Kikuchi
Prof. Madya Dr. Mohamad Shanudin Zakariya
Prof. Drs. Ec. Ir. Riyanarto Sarno, M.Sc.,Ph.D.
Priyantono Rudito Ph.D
Dr. Cahyo Crysdian
Dr. Suhartono, M.Kom
Dr. Muhammad Faisal, MT
Dr. Mokhamad Amin Haryadi, MT
Dr. H. Imam Sujarwo, M.Pd
Dr. Abdussakir, M.Pd
Dr. Drs. Usman Pagalay, M.Si
Dr. Agus Mulyono, M.Kes
Dr. Ulfah Utami, M. Si
Dr. Dra. Retno Susilowati, M.Si
Dr. Evika Sandi Savitri, MP
Elok Kamilah Hayati, M. Si
Yulia Eka Putrie, MT

Scientific Committee:

Supriyono, M.Kom
Fachrur Rozi, M.Si
Erna Hastuti, M.Si
Dr. Agung Sedayu, MT
Tri Kustono Adi, M.Sc
Dwi Suheriyanto, S.Si., M.P
Begum Fauziyah, M.Farm

Organizing Committe

Dr. Eko Budi Minarno, M.Pd
Citra Fidya Atmalia, SH
Muhammad Ismail Marzuki, SE
Tuti Indayani, SE
Mujahidin Ahmad, S.Pt., M.Sc
Roro Indah Melani, MT, M.Sc
Ririen Kusumawati, M.Kom
Ainatul Mardiyah, M.Cs
Rusianah, S.Kom
Nur Farida, S.Psi
Abidin, S.Pd
Hendri Cahyo Gunawan, S.Kom
Eka Arif Santoso
Aan Fuad Subarkah, S.Kom
Weni Susilowati, S.AB
Irjatul Wardah, S.Kom
Oktarina Eka Hartanti, SE
Muhammad Hatif, S.Pd I
Ernaning Setiyowati, MT
Ivana Varita, S.Kom
Prima Kurniawaty, ST., M.Si
Deny Zainal Arifin, S.Kom
Anton Prasetyo, S.Si
Ahmad Latif Qosim, S.Kom
Tarranita Kusumadewi, MT
Sri Winarni, MT
Gianto Widodo, S.Kom
Aziz Mustofa, S.Kom

FOREWORD

Sustainable development is development which meets the needs of the present without comprising the ability of future generations to meet their own needs. Sustainability is important because all the choices we pursue and all the actions that we make today will affect everything in the future. We need to make careful decisions at present in order to avoid limiting choices of the next generations at the future.

Sustainable development implies the fulfillment of several conditions: preserving the balance of the environment, preventing the exhaustion of natural resources, and optimizing the energy consumption. In the sustainable development action, there are many major challenges to be addressed. It requires us to re-think our growth in terms of social live that is more economical in its use of raw materials and energy. In this context, sustainable developments are now become an essential obligation.

Within the concept of rahmatan lil alamin, Islam considers it essential to preserve the environment and that the environmental management relies heavily on our actions today. To accommodate the above issues, the Faculty of Science and Technology of Maulana Malik Ibrahim State Islamic University dedicates an international seminar on science and technology "Innovation in Islamic perspective for sustainable development action toward international challenges".

We are delighted to invite the academicians, researchers, and practitioners to participate in this international seminar of

1. Natural science
2. Mathematics and Modeling
3. Computational Technology
4. Applied Science and Technology
5. Architecture
6. Pharmacy and Medical Technology

Best Regards

Committee

Table of Content

ANTIBACTERIAL ACTIVITY OF AWAR-AWAR LEAVES (*Ficus septica* Burm f) AGAINST *Staphylococcus aureus* ATCC 29523 AND *Escherichia coli* ATCC 35218

Arifah Khusnuryani[1], Zainatul Fuad[1]

[1]Department of Biology, Faculty of Science and technology, UIN Sunan Kalijaga, Yogyakarta, Indonesia
Email: anikarifah@yahoo.com

ABSTRACT

This research was conducted to observe the activity of ethanol extract of Awar-awar (*Ficus septica* Burm f) leaves as antibacterial against *Staphylococcus aureus* ATCC 29523 and *Escherichia coli* ATCC 35218 based on the formation of clear zone and analysis of cell leak. The result showed that ethanol extract of awar-awar leaves performed antibacterial activity against *S. aureus* ATCC 29523 and *E. coli* ATCC 35218. Based on the clear zone diamter, that antibacerial activity was categorized as medium. The analysis of cell leak using spectrophotometer at λ 260 nm and 280 nm did not indicate that ethanol extract of awar-awar leaves can cause cell leak on *S. aureus* ATCC 29523 and *E. coli* ATCC 35218.

Keywords

antibacterial activity, awar-awar leaves, E. coli ATCC 35218, S. aureus ATCC 29523

INTRODUCTION

Most of infectious diseases were caused by bacteria. *Staphylococcus aureus* and *Escherichia coli* are important pathogen which usualy resistant to some medicines. That resistance lead to difficulties in choosing appropriate antimicrobial for therapy. As reported by Depkes (2008) that many antibiotics have been used for curing of infectious diseases, however infection problem still continue. Volk and Wheeler (1993) stated that antibiotic cure can cause resistance of bacteria, then we need new product which potential as antibacterial to solve that infection problem.

Plants contain some active chemical compounds whic are potential to kill or inhibit bacterial growth. Awar-awar (*Ficus septica* Burm F) is one of potential plants that can be used for medication. This plant can be found in Java, Madura, and Sulawesi (Steenis, 2005). Awar-awar was used as traditional medication in Bali. Awar-awar leaves can be used as medicine for skin disease, appendix disease, *bisul*, snake bite, and asthma (Didik *et al*, 2002). The roots can be used to cure some stomachaches such as dysentri and cholerae, also to cure toxin and asthma (Segatri, 1995).

Awar-awar contains some chemical compounds such as saponin, flavonoid, and tanin, also alkaloid such as tilosrebrin (hauptalkaloid), tiloforin, septisin, and antofin. The leaves and roots contain stigmasterol and β-sitosterol. The roots

also contain sterol and polyphenol (Didik *et al*, 2012).

Some researches have been conducted to assess active compound of plants or natural compounds to inhibit *S. aureus* and *E. coli*. Those researches are *Azadirachta indica* (mimba) seed to inhibit *S. aureus* (Ambarwati, 2007) and *Anredera cordifolia* (binahong) leaves to inhibit *S. aureus* and *Pseudomonas aeruginosa* (Khumaifi, 2010). Other investigations of *S. aureus* growth inhibition were done using *Alpinia galanga* (Yuharmen *et al*, 2002), *Piper betle* leaves (Poeloengan *et al*, 2006; Hermawan *et al*, 2007), *Plumbago zeylanica L.* leaves (Poeloengan, 2009), and red betel leaves (Reveny, 2011). While *Curcuma xanthorriza* (Meilisa, 2008), *Artocarpus altilis* leaves (Sulistyaningsih *et al*, 2009), and *Morinda citrifolia* (Dewi, 2010) were used to inhibit *E. coli*.

Based on the above explanation, awar-awar has not been used for the investigation of *S. aureus* and *E. coli* inhibition. Some researches using awar-awar were the usage of methanol extract of awar-awar roots to inhibit *Vibrio cholera* and *E. coli* (Sukadana, 2000), also ethanol extract of awar-awar leaves againts cytotoxic activity of cancer cells (Sekti *et al*, 2010).

Our preliminary test showed that awar-awar leaves juice could inhibit *S. aureus* growth at concentration 25% (clear zone diameter 0,67 mm), 50% (clear zone diameter 1,0 mm), and 75% (clear zone diameter 2,0 mm). Those results show that awar-awar leaves juice could inhibit *S. aureus* growth even the inhibition was weak. Therefore we conducted this research using ethanol to extract the active compounds of awar-awar leaves.

Tabel 1. Clear zone diameter after the treatment of ethanol extract of Awar-awar leaves on *S. aureus* ATCC 29523 and *E. coli* ATCC 35218

No	Treatment		Diameter of clear zone (mm)	
			S. aureus ATCC 29523	*E. coli* ATCC 35218
1	Extract of Awar-awar leaves	10%	7,7	8
		20%	9,7	9
		30%	8.0	8.3

MATERIALS AND METHODS

1. **Ethanol extraction of awar-awar leaves powder**
   Extraction was proceed by maseration. Awar-awar leaves powder (200 g) was dissolved with 800 mL ethanol 96%. Sample was homogenized using shaker at 120 rpm for 24 hours. Than, sample was filtrated and the filtrat was evaporated until gel crude extract was formed.

2. **Antibacterial activity test of awar-awar leaves extract using disc difusion method**
   Bacterial culture of *S. aureus* ATCC 29523 dan *E. coli* ATCC 35218 (0,1 mL each) from NB medium was separately inoculated in NA medium using spread plate method. Various ethanol extract of awar-awar leaves (10%, 20%, 30%, 40%, dan 50%) were impregnated onto 5 mm paper disk and then placed on the seeded NA medium using a

sterile forceps. Plates were incubated for 24 hours at 37°C. and the diameter of the zone of inhibition around the disk is measured to the nearest millimeter (Greenwood, 1995). Based on Davis and Stout (1971), the inhibition activity is categorized as weak inhibition if the diameter of clear zone is ≤ 5 mm, as medium inhibition if the diameter is around 5-10 mm, as strong inhibition if the diameter around 10-19 mm, and as very strong if the diameter is ≥ 20 mm.

3. **Analysis of cell leak (Bunduki *et al*, 1995)**
   Bacterial suspension (10 mL) which has been grown along 24 hours was centrifuged at 3.500 rpm for 20 minutes. Filtrat was discharged and 5 mL NaCl 0,85% was added into cell sediment. Then, extract awar-awar leaves which produced smallest clear zone (concentration 10%) was added and incubated at 120 rpm, 37°C, for 24 hours. Similar bacterial suspension without extract addition was used as comparison. Next, bacteria-extract suspension wass centrifuged at 3.500 rpm for 20 minutes. The optical density of supernatan then was analyzed susing spectrophotometer UV-Vis at λ 260 nm for nucleic acid analysisi and at λ 280 nm for protein analysis.

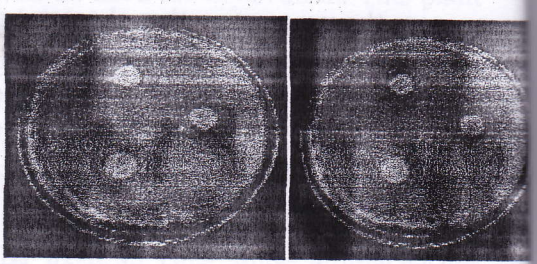
RESULTS

Data in **Table 1** shows that ethanol extract of awar-awar leaves with various concentartion can inhibit the growth of *S. aureus* ATCC 29523 and *E. coli* ATCC 35218. Based on Davis and Stout (1971), the inhibition was categorized as medium. The images of clear zone are shown on **Fig. 1** and **2**.

Test of bacterial cell leak of *S. aureus* ATCC 29523 and *E. coli* ATCC 35218 was conducted using spectrophotometer UV-Vis at λ 260 nm for measurement of nucleic acid nitrogen and at λ 280 nm for nitrogen of protein. The result is shown in **Table 2.**

DISCUSSION

Our preliminary study showed that juice of awar-awar leaves, with aquades as the solvent, can inhibit *S. aureus* ATCC 29523 growth with 2 mm clear zone diamater. Based on Davis and Stout (1971), that inhibition activity was categorized as weak, because the clear zone was < 5 mm. However, we conclude that awar-awar leaves were potential as antibacteria and can be improved by extracting it using another solvent.

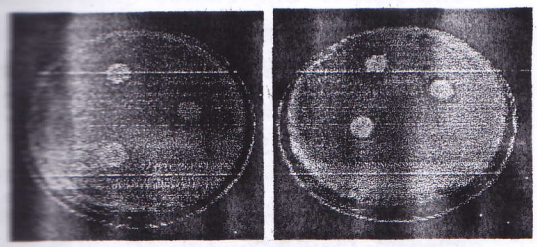


A B

Figure 1. The image of clear zone after the treatme 20% (A) and 30% (B) ethanol extract of A awar leaves on *S. aureus* ATCC 29523

...result of cell leak analysis using ...spectrophotometer at λ 260 nm and 280

Sample	Absorbance	
	λ 260 nm	λ 280 nm
...ATCC 29523	1,035	0,463
...ATCC 35218	0,885	0,434
...ATCC 29523 + ...	undetected	undetected
...ATCC 35218 + extract	undetected	undetected



A B

Figure 2. The image of clear zone after the treatment of 20% (A) and 30% (B) ethanol extract of Awar-awar leaves on *E. coli* ATCC 35218

Ethanol was choosen as extraction solvent, because it is a polar solvent, while active compounds in awar-awar leaves are polar compounds. Therefore it can extracte the active compounds effectively. Moreover, it is easy to get ethanol, ethanol is cheap, not easy to evaporate, and not affect the active compounds (Ahmad, 2006).

In this research we used *S. aureus* ATCC 29523 (Gram positive) and *E. coli* ATCC 35218 (Gram negative) to check the antibacterial spectrum of awar-awar leaves. ar-awar. Pelczar and Chan (1998) stated that a compound has wide spectrum if that compound can inhibit the growth of Gram positive and Gram negative bacteria. If the compound only inhibit the growth of Gram positif or Gram negative bacteria, then it can be categorized as a narrow spectrum compound. Based on the result (**Table 1** and **Fig. 2**), it can be concluded that ethanol extract of awar-awar leaves has wide spectrum antibacterial compound.

Awar-awar leaves contain some secondary metabolites, such as flavonoid, saponin, and tanin. Those secondary metabolites can be extracted using ethanol as solvent. Flavonoid can form complex compoud with extracelullar protein. That complex compound is able to be dissolved, then can damage bacterial cell membrane and followed by the release of intracellular ompounds of bacterial cell. Tanin can vrinkle bacterial cell wall or membrane, herefore it can disturb cell permeability vhich lead to growth disturbation. While aponin can damage cell membrane by lecreasing cell wall turgor which can lead o cell wall lysis.

Usually, the diameter of clear zone vill increase parallel with the increase of kxtract concentration. However, in this esearch we found that the celar zone liameter was decrease when the extract oncentration was increased to 30%. Dewi 2010) stated that the increase of clear zone diameter not always corespond with the increase of antibacterial concentration. Antibacterial activity can be affected by the concentration of antibacterial compound, temperature, pH, microbial species, and organic compound.

The result showed that *S. aureus* ATCC 29523 and *E. coli* ATCC 35218 gave different respond to our treatment. *S. aureus* ATCC 29523 was more sensitive to the extract than *E. coli* ATCC 35218. Cell wall stucture of *S. aureus* ATCC 29523 is more simple than of *E. coli* ATCC 35218. The cell wall of *S. aureus* ATCC 29523 is composed of one thick layer, while cell wall of *E. coli* ATCC 35218 is composed of some layers. Therefore, *S. aureus* ATCC 29523 more sensitive to antibacterial compounds.

The bacterial respond to ethanol extract of awar-awar leaves was also observed by analysing the disturbance or damage of membrane cell, based on the bacterial growth medium turbidity. Bacterial cell membrane damage was measured based on the compounds which is released by the cell, those are nitrogen from nucleic acid (measured at λ 260 nm) and nitrogen from protein (measured at λ 280 nm).

Data in **Table 2** shows that the absorbance at λ 260 nm and 280 nm were undetected. That undectected absorbance perhaps was caused by the intense color of awar-awar leaves extract. Therefore spectrophotometer UV-Vis could not detect the nucleic acid and protein which were released from bacterial cell.

Different result was shown by Febriyanti (2010) who observed the effect of betel leaf volatile oil fraction against Gram positive bacteria such as *Bacillus subtilis*, *S. mutan*, and *S. aureus*. While Azis (2010) observed the antibacterial mechanism of ethanol extract of white lily bulbs againts *Propionibacterium acnes*, *S. aureus*, dan *S. epidermis*. Both showed the increase of absorbance when bacteria were contacted with the extract. It can be summarized that the different result of our research with those two researches can be affected by the different of the extracted material, the kind of extract, and the strain of bacteria. Next observation using other methods is recommended to observe the antibacterial mechanism of ethanol extract of awar-awar leaves.

CONCLUSION

1. Ethanol extract of awar-awar leaves can inhibit the growth of *Staphylococcus aureus* ATCC 29523 and *Escherichia coli* ATCC 35218. The inhibition was categorized as medium inhibition.
2. Antibacterial mechanism of ethanol extract of awar-awar leaves against *Staphylococcus aureus* ATCC 29523 and *Escherichia coli* ATCC 35218 could not be observed based on the analysis of cell leak.

REFERENCES

Achmad, S.A. 2006. Materi Pokok Kimia Organik Bahan Alam. Karunika, Jakarta

Ambarwati. 2007. Efektivitas Zat Antibakteri Biji Mimba (*Azadirachta indica*) untuk Menghambat Pertumbuhan *Salmonella thyposa* dan *Staphylococcus aureus*. Biodiversitas, 8 (3): 320-325. ISSN: 1412-033X.

Azis, S. 2010. Uji Aktivitas Antibakteri Ekstrak Etanol Daun dan Umbi Bakung Putih (*Crinum Asiaticum* L.) terhadap Bakteri Penyebab Jerawat. Fakultas Kedokteran dan Ilmu Kesehatan, UIN Syarif Hidayatullah, Jakarta

Bunduki, MMC, Handler, KJ., and Donnell NC. 1995. Metabolic and structural sites of damage in heat and sanitizer injured population of *Listeria monocytogenes*. *Food Protec.* 58:410-415

Davis, W. and Stout, T. 1971. Disc plate method of microbiological antibiotic assay. *Appl Microbiol, 22* (4), 659–665

Departemen Kesehatan dan Kesejahteraan Sosial RI. 2008. Inventarisasi Tanaman ObatIndonesia 1 jilid 1. Badan Penelitian dan Pengembangan Kesehatan, Jakarta

Dewi, F.K. 2010. Aktivitas Antibakteri Ekstrak Etanol Buah Mengkudu

(*Morinda citrifolia* L) Terhadap Bakteri Pembusuk Daging Segar. Fakulktas Matematika dan Ilmu Pengetahuan Alam UNS ,Surakarta.

G, Sudarsono P., Imono A., dan Purnomo. 2002. Tumbuhan Obat II. Pusat Studi Obat tradisional UGM, Yogyakarta.

Nuryanti. 2010. Analisis Komponen Kimia Fraksi Minyak Atsiri Daun Sirih (*Piper betle* Linn) dan Uji Aktivitas Antibakteri terhadap Beberapa Jenis Bakteri Gram Positif. Fakultas Kedokteran dan Ilmu Kesehatan UIN Syarif Hidayatullah, Jakarta.

Ghozali, M. 2010. Uji Aktivitas Antibakteri Ekstrak Daun Binahong (*Anredera cordifolia* (Ten) Steenis) terhadap Bakteri *Staphylococcus aureus* dan *Pseudomonas aeruginosa*. Jurusan Biologi Fakultas Sains dan Teknologi UIN Malang.

Melissa. 2008. Uji Aktivitas Antibakteri dan Formulasi dalam Sediaan Kapsul dari Ekstrak Etanol Rimpang Tumbuhan Temulawak (*Curcuma Xanthorrhiza* Roxb) terhadap beberapa Bakteri.[Skripsi]. Fakultas Farmasi USU Medan

Pelczar, M and Chan. 1998. Dasar-Dasar Mikrobiologi 1. UI-Press, Jakarta

Poeloengan, M. 2009. Aktivitas Air Perasan dan Ekstrak Etanol daun Encok Terhadap Bakteri yang Diisolasi dari Sapi Mastitis Subklinis. Seminar Nasional Teknologi Peternakan dan Veteriner, Bogor.

Reveny, J. 2011. Daya Antimikroba Ekstrak dan Fraksi Daun Sirih Merah (*Piper betle* Linn). Jurnal Ilmu Dasar Fakultas Farmasi Universitas Sumatra Utara (12): 6-12.

Sekti, D.A., Mubarok M.F., Armandani I., Junedy S., and Meiyanto E. 2010. Ekstrak Etanolik Daun Awar-awar (*Ficus septica* Burm f) memacu Apoptosis Sel Kanker Payudara MCF-7 Melalui Penekanan Ekspresi Bcl-2. Majalah Obat Tradisional, 15 (3) : 100-104.

Segatri, P. 1995. Taru Premana Khasiat Tanaman Obat untuk Obat Tradisional. Upada Sastra, Denpasar

Sukadana, I M. 2000. Aktivitas Antibakteri Senyawa Flavonoid dari Kulit Akar Awar-awar (*Ficus septica* Burm f). Chemical Review. 4 (3) : 63-70.

Sulistiyaningsih, Rostinawati T., Permana C., 2009. Aktivitas Antimikroba Ekstrak Etanol Dau Sukun (*Artocarpus altilis* [Parkins] Fosbberg) terhadap Bakteri *Escherichia coli, Bacillus subtilis* dan Jamur *Candida albicans, Micosporum gypsium*. Farmaka Vol. 7 (1) : 1-14

Van Steenis C.G.G.J., 2005. Flora-flora. PT Pradnya Paramita, Jakarta

Volk, W.A., and Wheeler, 1993. Mikrobiologi Dasar Jilid I Edisi kelima (Translate: Markham. Erlangga, Jakarta

Yuharmen., Eryanti Y., and Nurbalatif. 2002. Uji aktivitas Antimikroba Minyak Atsiri dan Ekstrak Metanol Lengkuas (*Alpina galanga*). Jurusan Kimia FMIPA Universitas Riau